

PATENT COOPERATION TREATY

Patent Mail Received

From the INTERNATIONAL SEARCHING AUTHORITY

Patent Mail Received PCT OCT 27 2008

To:
 DORSEY & WHITNEY LLP
 Attn. Abelev, Gary
 250 Park Avenue
 New York, NY 10177
 ETATS-UNIS D'AMERIQUE

OCT 27 2008
 NOTIFICATION OF TRANSMITTAL OF
 THE INTERNATIONAL SEARCH REPORT AND
 THE WRITTEN OPINION OF THE INTERNATIONAL
 SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

| | |
|---|--|
| Date of mailing (day/month/year) | 22/10/2008 |
| Applicant's or agent's file reference 189147/PCT | FOR FURTHER ACTION See paragraphs 1 and 4 below |
| International application No. PCT/US2008/057835 | International filing date (day/month/year) 21/03/2008 |
| Applicant THE GENERAL HOSPITAL CORPORATION | |

1. The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the International Search Report.

Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: (41-22) 338.82.70

For more detailed instructions, see the notes on the accompanying sheet.

2. The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

- the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. Reminders

Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until **30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the International Searching Authority

 European Patent Office, P.B. 5818 Patenttaan 2
 NL-2280 HV Rijswijk
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
 Fax: (+31-70) 340-3016

Authorized officer
 Iveta Smajda

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| | | |
|--|---|---|
| Applicant's or agent's file reference 189147/PCT | FOR FURTHER ACTION | see Form PCT/ISA/210 as well as, where applicable, item 5 below. |
| International application No. PCT/US2008/057835 | International filing date (day/month/year) 21/03/2008 | (Earliest) Priority Date (day/month/year) 23/03/2007 |
| Applicant THE GENERAL HOSPITAL CORPORATION | | |

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 5 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of:
 - the international application in the language in which it was filed
 - a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
- b. This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6(b)(a)).
- c. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. **Certain claims were found unsearchable** (See Box No. II)

3. **Unity of invention is lacking** (see Box No III)

4. With regard to the **title**,

- the text is approved as submitted by the applicant
- the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- the text is approved as submitted by the applicant
- the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 1
 - as suggested by the applicant
 - as selected by this Authority, because the applicant failed to suggest a figure
 - as selected by this Authority, because this figure better characterizes the invention

- b. none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2008/057835

Box No. IV Text of the abstract (Continuation of item 5 of the first sheet)

Exemplary systems and methods for filtering an electromagnetic radiation can be provided. For example, at least one first arrangement (4) can be provided which is capable of receiving at least one first electro-magnetic radiation and forwarding at least one second electro-magnetic radiation at different angles with respect to a direction of incidence of the first electro-magnetic radiation. At least one second wavelength dispersion arrangement (5) can be provided which is configured to receive the second electro-magnetic radiation, forward at least one third electro-magnetic radiation to the first arrangement (4) and further receive at least one fourth electro-magnetic radiation. The third electro-magnetic radiation can be based on the second electro-magnetic radiation, and the fourth electro-magnetic radiation can be based on the third electro-magnetic radiation. For example, the second arrangement can be configured to forward the second electro-magnetic radiation at different angles with respect to a direction of incidence of the at least one particular electro-magnetic radiation. Exemplary embodiments of methods can be provided to implement such exemplary techniques.

A. CLASSIFICATION OF SUBJECT MATTER
 INV. H01S3/1055 H01S3/08
 ADD. H01S5/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01S G01N A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, INSPEC, COMPENDEX, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| X | US 2006/193352 A1 (CHONG CHANGHO [JP] ET AL) 31 August 2006 (2006-08-31) paragraphs [0032], [0-41], [0050], [0053], [0057] - [0059]; figures 1,2,9,14,15 | 1-28 |
| X | US 7 099 358 B1 (CHONG CHANGHO [JP]) 29 August 2006 (2006-08-29) column 4, line 18 - column 6, line 42 column 9, lines 20-44; figures 1,13 | 1-28 |
| A | US 2005/035295 A1 (BOUMA BRETT [US] ET AL) 17 February 2005 (2005-02-17) paragraphs [0036] - [0056], [0058], [0061]; figures 1A-1G,3,6 | 1,11,27, 28 |

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than 1 year prior to the claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

9 October 2008

22/10/2008

Name and mailing address of the ISA/
 European Patent Office, P.O. 5818 Patentlaan 2
 NL - 2280 HT Rijswijk
 Tel. (+31-70) 340-2040,
 Fax: (+31-70) 340-3016

Authorized officer

Gnugesser, Hermann

(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|----------|--|-----------------------|
| A | US 4 868 834 A (FOX JAY A [US] ET AL) 19 September 1989 (1989-09-19) column 1, line 65 - column 2, line 68; figure 1 ----- | 1,11,27, 28 |
| A | FOX J A ET AL: "A new galvanometric scanner for rapid tuning of CO ₂ lasers" PROCEEDINGS OF SOUTHEASTCON. WILLIAMSBURG, APRIL 7 - 10, 1991; [PROCEEDINGS OF THE SOUTHEAST CONFERENCE], NEW YORK, IEEE, US, vol. -, 7 April 1991 (1991-04-07), pages 1255-1256, XP010045017 ISBN: 978-0-7803-0033-0 the whole document ----- | 1,11,27, 28 |
| P, X | MOTAGHIAN NEZAM S M R ET AL: "High-Speed Wavelength-Swept Semiconductor Laser Using a Diffraction Grating and a Polygon Scanner in Littrow Configuration" OPTICAL FIBER COMMUNICATION AND THE NATIONAL FIBER OPTIC ENGINEERS CON FERENCE, 2007. OFC/NFOEC 2007. CONFERENCE/ ON, IEEE, PI, 25 March 2007 (2007-03-25), - 29 March 2007 (2007-03-29) pages 1-3, XP031146281 ISBN: 978-1-55752-831-5 the whole document ----- | 1-28 |

Information on patent family members

International application No

PCT/US2008/057835

| Patent document cited in search report | | Publication date | | Patent family member(s) | | Publication date |
|--|----|------------------|----------|-------------------------------|--|--------------------------|
| US 2006193352 | A1 | 31-08-2006 | JP US | 2006237359 A 2006251131 A1 | | 07-09-2006 09-11-2006 |
| US 7099358 | B1 | 29-08-2006 | JP | 2007042971 A | | 15-02-2007 |
| US 2005035295 | A1 | 17-02-2005 | US | 2008181263 A1 | | 31-07-2008 |
| US 4868834 | A | 19-09-1989 | NONE | | | |

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

| | | |
|--|--|--|
| Date of mailing (day/month/year) see form PCT/ISA/210 (second sheet) | | |
| Applicant's or agent's file reference see form PCT/ISA/220 | | FOR FURTHER ACTION See paragraph 2 below |
| International application No. PCT/US2008057835 | International filing date (day/month/year) 21.03.2008 | Priority date (day/month/year) 23.03.2007 |
| International Patent Classification (IPC) or both national classification and IPC INV. H01S3/1055 H01S3/08 ADD. H01S5/14 | | |
| Applicant THE GENERAL HOSPITAL CORPORATION | | |

1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

| | | |
|--|--|--|
| Name and mailing address of the ISA:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465 | Date of completion of this opinion see form PCT/ISA/210 | Authorized Officer Gnugesser, Hermann Telephone No. +49-89 2399-2526 |
|--|--|--|



WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2008/057835

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - the international application in the language in which it was filed
 - a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).
2. This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - a sequence listing
 - table(s) related to the sequence listing
 - b. format of material:
 - on paper
 - in electronic form
 - c. time of filing/furnishing:
 - contained in the international application as filed.
 - filed together with the international application in electronic form.
 - furnished subsequently to this Authority for the purposes of search.
4. In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

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Box No. IV Lack of unity of invention

1. In response to the invitation (Form PCT/ISA/206) to pay additional fees, the applicant has, within the applicable time limit:
 - paid additional fees
 - paid additional fees under protest and, where applicable, the protest fee
 - paid additional fees under protest but the applicable protest fee was not paid
 - not paid additional fees
2. This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is
 - complied with
 - not complied with for the following reasons:
see separate sheet
4. Consequently, this report has been established in respect of the following parts of the international application:
 - all parts.
 - the parts relating to claims Nos.

**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or
industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | | |
|-------------------------------|------|--------|-------------------|
| Novelty (N) | Yes: | Claims | |
| | No: | Claims | <u>1,11,27,28</u> |
| Inventive step (IS) | Yes: | Claims | |
| | No: | Claims | <u>2-10,12-26</u> |
| Industrial applicability (IA) | Yes: | Claims | <u>1-28</u> |
| | No: | Claims | |

2. Citations and explanations

see separate sheet

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

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Box No. VI Certain documents cited

1. Certain published documents (Rules 43bis.1 and 70.10)
and / or
2. Non-written disclosures (Rules 43bis.1 and 70.9)

see form 210

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item IV

Lack of unity of invention

Due to the lack of inventive step it appears that the requirement of unity of invention (Rule 13.1 and 13.2 PCT) is no longer fulfilled for the independent claims 1, 11, 27 and 28.

There are no special or corresponding special technical features in claims 1, 11, 27 and 28 which make a contribution over the prior art so that the subject-matter of these claims is not linked by a common novel and inventive idea represented by technical device features.

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1. Reference is made to the following documents:

D1: US 2006/0193352 A1
D2: US 7 099 358 B1

2. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1, 11, 27 and 28 is not new in the sense of Article 33(2) PCT.

- 2.1 Claim 1:

Document D1 (see: fig. 15; [0057]) discloses an apparatus for filtering an electromagnetic radiation, comprising:

- at least one first arrangement (25) configured to receive at least one first electro-magnetic radiation (light from optical fiber 21) and forward at least one

second electro-magnetic radiation (L1) at different angles with respect to a direction of incidence of the at least one first electro-magnetic radiation (see fig. 15); and

- at least one second wavelength dispersion arrangement (27) configured to receive the at least one second electro-magnetic radiation (L1), forward at least one third electro-magnetic radiation (L2) to the at least one first arrangement (25) and further receive at least one fourth electro-magnetic radiation (L3), wherein the at least one third electro-magnetic radiation (L2) is based on the at least one second electro-magnetic radiation (L1), and wherein the at least one fourth electro-magnetic radiation (L3) is based on the at least one third electro-magnetic radiation (L2) - (see especially page 6, left-hand column, lines 15 - 23).

Remark:

It is assumed that the embodiment of D1, fig. 14 constitutes a Littrow arrangement as e.g. disclosed on page 3, left-hand column, [0033]). The rotation speed of the polygon mirror, the distance between the mirror (25) and the dispersive element (27) as well as the speed of light of signals L1, L2 lead to a situation where in the embodiment of fig. 14 part of the light (L2) reflected from grating 27 to the polygon mirror (25) and incident on one of the polygon mirror facets is again reflected back to the grating (27). According to the Littrow arrangement there is always a position of one of the polygon mirror facets and the grating surface where multiple reflection between the polygon mirror facet and the grating is possible. In this case all technical features defined in claim 1 can be derived from the embodiment of fig. 14.

For the above reasons document D2, fig. 1, 13 and description column 4, line 18 - column 6, line 30 and column 9, lines 21 - 44 also discloses the technical features of claim 1.

2.2 Claim 11:

From document D1, fig. 15 (see: fig. 15; [0057]; see especially page 6, left-hand column, lines 15 - 23) and corresponding description a source arrangement

for providing at least one particular electromagnetic radiation is known. The source arrangement comprises:

- at least one emitter arrangement configured to provide the at least one electromagnetic radiation (implicitly known - although not explicitly disclosed, there is nevertheless some kind of light emitter, e.g. fiber laser light source, which provides light via fiber 21 and lens 22);
- at least one first arrangement (25) configured to receive the at least one particular electro-magnetic radiation (light transmitted via fiber 21 and lens 22) and forward at least one first electro-magnetic radiation (L1) at different angles with respect to a direction of incidence of the at least one particular electro-magnetic radiation; and
- at least one second wavelength dispersion arrangement (27) configured to receive the at least one first electro-magnetic radiation (L1), forward at least one second electro-magnetic radiation (L2) to the at least one first arrangement (L2) and further receive at least one third electro-magnetic radiation (L3), wherein the at least one second electro-magnetic radiation (L2) is based on the at least one first electro-magnetic radiation (L1), and wherein the at least one third electro-magnetic radiation (L3) is based on the at least one second electro-magnetic radiation (L2).

The remark of point 2.1 above also applies to the subject-matter of claim 11.

2.3 Claim 27:

For the reasons of point 2.1 above, the method of claim 27 is known from D1 and D2.

2.4 Claim 28:

For the reasons of point 2.2 above, the method of claim 28 is known from D1 and D2.

3. Dependent claims 2 - 10 and 12 - 26 do not contain any features which, in

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING
AUTHORITY (SEPARATE SHEET)**

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combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step, the reasons being as follows:

claims 2, 4, 6, 7, 18, 20, 22, 23:

see D1 and D2 - rotating polygon mirror (D1 - ref. number 25; D2 - ref. number 24); the dispersive element of D1 and D2 is a diffraction grating;

claims 3, 5, 8, 9, 10, 15, 19, 21, 24, 25, 26:

Matter of normal design.

claims 12, 13, 14:

see ring cavity in documents D1 and D2; the ring cavity either comprises a doped fiber or a SOA (semiconductor optical amplifier);

claims 16:

see D1 and D2 (the wavelength filter comprising the polygon mirror and the diffraction grating is connected via at least one optical circulator connected to the ring laser);

claim 17:

see D1 and D2.

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Re Item VI

Certain documents cited

Non-written disclosures

| Kind of non-written disclosure | Date of non-written disclosure (day/month/year) | Date of written disclosure referring to non-written disclosure (day/month/year) |
|---|--|---|
| OPTICAL FIBER COMMUNICATION AND THE NATIONAL FIBER OPTIC ENGINEERS CONFERENCE, 2007. OFC/NFOEC 2007. CONFERENCE ON, IEEE, PI | 25.03.2007-29.03.2007 | 25.03.2007-29.03.2007 |

Re Item VII

Certain defects in the international application

1. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
2. Independent claims are not in the two-part form in accordance with Rule 6.3(b) PCT with those features known in combination from the prior art being placed in the

preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

3. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.

Re Item VIII

Certain observations on the international application

The application does not meet the requirements of Article 6 PCT, because claims 1, 7, 11, 17, 23, 27 and 28 are not clear.

1. Claims 1, 11, 27 and 28:

It appears that some embodiments described with respect to fig. 1, 2A - 8D do not fall within the scope of the claims. This inconsistency between the claims and the description leads to doubt concerning the matter for which protection is sought, thereby rendering the claims unclear, Article 6 PCT.

In claims 1, 9, 25 and 26 it is defined that the wavelength dispersion arrangement further receives a fourth electro-magnetic radiation. As far as the application can be understood this fourth electro-magnetic radiation is electro-magnetic radiation from the dispersive element (diffraction grating) which is deflected a second time by the rotating mirror towards the dispersive element. Throughout the description only with respect to the embodiments of fig. 2C and 2D a fourth electro-magnetic radiation is disclosed (see: page 19, lines 4 - 7; page 21, lines 12 - 17). The description as well as the figures of the other embodiments are silent with respect to a fourth electro-magnetic radiation received by the dispersive element.

2. Claims 7, 23:

It is unclear what should be defined by the term "grism" used in claim 5 and on page 5, line 3 and on page 6, line 24. This term is not defined throughout the application.

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Remark: In this context it is to be noted that claims must be clear in themselves when read using normal skills, including knowledge of the prior art but not any knowledge derived from the description contained in the patent application,

3. Claim 11 "missing antecedent":

In claim 11 (page 42, lines 11 - 12) the term "the at least one electromagnetic radiation" has no suitable antecedent. The radiation is apparently "the at least one **particular** electromagnetic radiation".

4. Claim 27 "missing essential feature"

It appears that the technical feature "dispersive arrangement" as defined in claims 1, 9 and 26 is essential to solve the problem posed by the applicant. Since independent claim 27 does not contain this feature it does not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

Remark:

According to the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT any independent claim must contain all the technical features essential to the definition of the invention. Therefore, the technical features of claims 1, 11 and 28 appear to be essential for the invention. It is, however, to be noted that e.g. claim 25 does not comprise all of the technical features defined in claims 1, 11 and 28 (e.g. "dispersive element"). Therefore, it appears that in independent claim 27 an essential feature is missing, contrary to Art. 6 PCT.

5. Claim 17:

It is evident that an emitter in an emitter arrangement has a certain wavelength range. It is, however, not clear how a single emitter arrangement can have **different** wavelength ranges (more than one wavelength range). Throughout the application

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there is no further explanation for these wavelength ranges.

Remark: In this context it is to be noted that claims must be clear in themselves when read using normal skills, including knowledge of the prior art but not any knowledge derived from the description contained in the patent application. It is, however, to be noted that the application as filed is silent with respect to a further explanation of the "different wavelength ranges".

Possible steps after receipt of the international search report (ISR) and written opinion of the International Searching Authority (WO-ISA)

| | |
|---|--|
| General information | For all international applications filed on or after 01/01/2004 the competent ISA will establish an ISR. It is accompanied by the WO-ISA. Unlike the former written opinion of the IPEA (Rule 66.2 PCT), the WO-ISA is not meant to be responded to, but to be taken into consideration for further procedural steps. This document explains about the possibilities. |
| Amending claims under Art. 19 PCT | Within 2 months after the date of mailing of the ISR and the WO-ISA the applicant may file amended claims under Art. 19 PCT directly with the International Bureau of WIPO. The PCT reform of 2004 did not change this procedure. For further information please see Rule 46 PCT as well as form PCT/ISA/220 and the corresponding Notes to form PCT/ISA/220. |
| Filing a demand for international preliminary examination | In principle, the WO-ISA will be considered as the written opinion of the IPEA. This should, in many cases, make it unnecessary to file a demand for international preliminary examination. If the applicant nevertheless wishes to file a demand this must be done before expiry of 3 months after the date of mailing of the ISR/ WO-ISA or 22 months after priority date, whichever expires later (Rule 54bis PCT). Amendments under Art. 34 PCT can be filed with the IPEA as before, normally at the same time as filing the demand (Rule 66.1 (b) PCT). If a demand for international preliminary examination is filed and no comments/amendments have been received the WO-ISA will be transformed by the IPEA into an IPRP (International Preliminary Report on Patentability) which would merely reflect the content of the WO-ISA. The demand can still be withdrawn (Art. 37 PCT). |
| Filing informal comments | After receipt of the ISR/WO-ISA the applicant may file informal comments on the WO-ISA directly with the International Bureau of WIPO. These will be communicated to the designated Offices together with the IPRP (International Preliminary Report on Patentability) at 30 months from the priority date. Please also refer to the next box. |
| End of the international phase | At the end of the international phase the International Bureau of WIPO will transform the WO-ISA or, if a demand was filed, the written opinion of the IPEA into the IPRP, which will then be transmitted together with possible informal comments to the designated Offices. The IPRP replaces the former IPER (international preliminary examination report). |
| Relevant PCT Rules and more information | Rule 43 PCT, Rule 43bis PCT, Rule 44 PCT, Rule 44bis PCT, PCT Newsletter 12/2003, OJ 11/2003, OJ 12/2003 |

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A NEW GALVANOMETRIC SCANNER FOR RAPID TUNING OF CO₂ LASERS

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ABSTRACT

A device for rapidly tuning both cw and TEA CO₂ lasers is presented. This galvanometer-driven unit is of considerable improvement over that previously reported in that it can attain at least 200 Hz tuning without the need for additional equipment or algorithms.

INTRODUCTION

As we have previously noted¹, there is a possibility that a single laser can be used in a differential absorption lidar system (DIAL) for the remote sensing of gases. This may be accomplished only if the laser can be tuned at high (more than 100 Hz) pulse tuning rates so as to minimize the effects of atmospheric turbulence². We have already reported on two methods of tuning a CO₂ laser^{3,4} at these high rates. One involved the combination of a rotating octagonal mirror and a fixed grating installed in a laser cavity. Although this method is capable of very fast line switching operation (>400 Hz), it may not be suitable for a small, portable differential lidar system because of its relatively large size. In addition, as we have pointed out, rotating grating scanners are not usable in heterodyne detection systems. The other method involved the use of a galvanometer scanner. This is potentially superior to the rotating mirror device in that it can be made smaller and lighter and is suitable for heterodyne detection systems. The then-currently available galvo scanner was the General Scanning Inc. model G325 DT. We reported that a pulsed CO₂ laser could be made to switch lines as fast as 140 Hz, however, amplitude-dependent position adjustments were necessary in order to compensate for settling time and/or thermal drift effects. It was concluded that reproducible operation was not practical without a device to rapidly sense mirror position and utilize an automated feedback loop for corrections. In this paper we report on an off-the-shelf galvo system that does not need this compensation. Experiments have been performed with both a CW system for heterodyne detection applications, and a pulsed transversely excited atmospheric laser (TEA) for direct detection applications.

CW EXPERIMENT

The laser used for this portion of the experiment was a typical low-pressure device with an 80-cm gain length, a cavity 1.3 m

in length, and a flat, 150-line/mm grating. The 93% output coupler with a 3-m-radius of curvature was driven with a piezoelectric transducer in order to provide cavity length stabilization. Wavelength tuning was achieved with a Cambridge Technology, Inc. Model 6060 galvanometer (CT6600) which includes a turning mirror in order to scan the cavity axis across the fixed grating. The device was driven by a microcomputer and a 12-bit D to A converter with resolution sufficient to move the mirror in discrete intervals as small as 12.5 μ rad, which was more than sufficient to find the optimum position for any lasing transition. See figure 1 for a schematic of the setup.

The maximum tuning rate achievable with these devices is at least partially determined by the settling time, i.e. the length of time it takes to attain maximum power when switching from one line to another. A measurement of the output power as a function of switching time was performed with the aid of a HgCdTe detector. It was found that the time required to settle switching from 10P20 to 9R36 was no more than 5.5 ms, which indicates that line switching is possible at rates up to 180 Hz. It should be noted that this is more than twice as fast as that previously obtainable with the G325 DT device. In that case, the minimum settling time was 13 ms, or a switching rate of 77 Hz. Even faster switching is possible if the amplitude is restricted. For example, switching between adjacent lines at a rate of more than 400 Hz was performed with no reduction in power. This is, again, considerably faster than that attainable with the G325 DT device (250 Hz). (It should be noted that performance with closely-spaced lines is relevant for remote detection by DIAL in order to minimize situations where the target reflectivity is a function of the wavelength of the incident radiation.)

Previous experiments with the G325 DT galvo revealed the fact that it was quite sensitive to self-heating of the drive coil even in a quiescent state. (This occurred in spite of the fact that that model was temperature compensated with a thermal blanket.) For example, after it was first turned on, the galvanometer drifted about 600 μ rad during the first hour until it finally became relatively stable, with motions of about 20 μ rad during 20 minute periods. In contrast, the CT6600 unit drifted less than 12.5 μ rad/hr, the minimum motion detectable with our apparatus. In addition, this unit was extremely stable under actual operating conditions. For example, even after switching between the 10P20 and 9R36 lines at 70 Hz for 15 minutes, it was found that no drift could be detected, (that is,

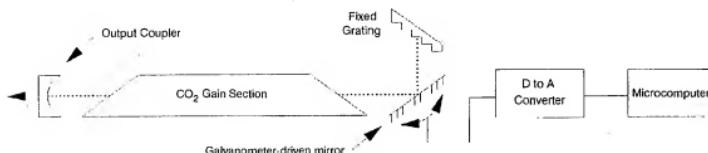


Figure 1: Experimental setup

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the *PCT Applicant's Guide*, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions, respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report and the written opinion of the International Searching Authority, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only (see *PCT Applicant's Guide*, Volume I/A, Annexes B1 and B2).

The attention of the applicant is drawn to the fact that amendments to the claims under Article 19 are not allowed where the International Searching Authority has declared, under Article 17(2), that no international search report would be established (see *PCT Applicant's Guide*, Volume I/A, paragraph 296).

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14, claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments and any accompanying statement, under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the time of filing the amendments (and any statement) with the International Bureau, also file with the International Preliminary Examining Authority a copy of such amendments (and of any statement) and, where required, a translation of such amendments for the procedure before that Authority (see Rules 55.3(a) and 62.2, first sentence). For further information, see the Notes to the demand form (PCT/PEA/401).

If a demand for international preliminary examination is made, the written opinion of the International Searching Authority will, except in certain cases where the International Preliminary Examining Authority did not act as International Searching Authority and where it has notified the International Bureau under Rule 66.1 bis(b), be considered to be a written opinion of the International Preliminary Examining Authority. If a demand is made, the applicant may submit to the International Preliminary Examining Authority a reply to the written opinion together, where appropriate, with amendments before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later (Rule 43bis.1(c)).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see the *PCT Applicant's Guide*, Volume II.